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Original Research Article

Fungal Bio-agent for Management of Root Knot Nematode *Meloidogyne graminicola* in Rice

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Bio-agent, Management, Meloidogyne graminicola and rice

A B S T R A C T

Plant parasitic nematode infestation is one of the major factors responsible for low productivity of rice. The root-knot nematode, *Meloidogyne graminicol,* is the important nematode problem in rice cultivation throughout the globe. Bio- control of plant parasitic nematodes by use of fungal bio-agents is an important sustainable management practice. A two years trial conducted for management of root-knot nematode, *Meloidogyne graminicola* in transplanted rice revealed that the application of Carbofuran @ 0.3 g a.i/m^2 in the nursery bed and field application of fungal bio-agent *Trichoderma viride* @2.5 kg /ha incubated with 25 kg FYM at 45 days after transplanting is quite effective and economic for the nematode management with increased grain yield and highest incremental cost-benefit ratio.

Introduction

Plant parasitic nematode infestation is one of the major factors responsible for low productivity of rice (Jain *et al.*, 2007). The root-knot nematode, *Meloidogyne graminicola*, seems to be an emerging problem in rice cultivation throughout the globe (Prasad *et al.*, 1987 and Pankaj *et al.*, 2010). The yield loss to the tune of 32% in upland water stressed situation has been recorded due to this nematode (Rao and Biswas, 1973). In Odisha, infested rice nurseries particularly in coastal districts have frequently been noticed with a serious threat to the rice production of the state (Mohanty and Mohapatra, 2009). Most of the farmers are unaware about the harmful effect of this nematode since soil application of granular insecticides like Carbofuran, Phorate and Cartap hydrochloride by them for management of insect pests subsides this nematode problem to some extent. However, the yield is reduced due to poor plant growth because of nematode infestation. Although the insecticides used by them are effective and fast-acting for pest control, they are currently being reappraised with respect to the environmental hazards and human health. Hence, eco-friendly techniques of exploitation of native bio-agents for insect pest and nematode management are undoubtedly the need of the hour.

Bio- control of plant parasitic nematodes in general and use of fungal bio-agents in particular is now regarded as an important component of integrated nematode management system due to its self-sustaining approach. An attempt was thus made to test the efficacy of three fungal bio-agents for management of root knot nematode *Meloidogyne graminicola* in rice.

Materials and Methods

The trial was conducted in the Experimental plots of Orissa University of Agriculture and Technology, Bhubaneswar during the kharif, 2012 and 2013 on rice var. Pratikshya. It was laid down with five treatments and four replications under RBD.

A uniformly infested field was selected with initial nematode population of 258 J_2/200 cc soil. Nursery was prepared in usual process with application of Carbofuran @ 0.3 g a.i./m^2 and transplanting was carried out taking the initial observation of number of galls/20 seedlings.

Three fungal bio-agents viz. *Trichoderma viride, Pochonia chlamydosporia* and *Purpureocillium lilacinum* were applied @ 2.5 kg/ha incubated with 25 kg FYM at 45 DAT. A standard chemical check with Carbofuran @ 1.0 kg a.i./ha and untreated control plots were also maintained. Other cultural operations including fertilizer application and management of insect pests, diseases and weeds were followed uniformly as per standard recommendations. At around 90% maturity of the grains, the crop was harvested; final nematode population in 200 cc soil and 5 g root was recorded. The cost of cultivation and incremental cost – benefit ratio (ICBR) was calculated from two years pooled data as per prevailing rate and analyzed.

Results and Discussion

The experimental data (Table 1) indicated significant effect of all the treatments over untreated control. Application of Carbofuran both in the nursery bed as well as in the main field (T_5) performed better in reducing the number of nematodes both in the soil and roots to the tune of 47.5% and 74.2% respectively and increased the grain yield by 26.9% over untreated check.

Similar observations have reported earlier by Fademi (1984), Gaur (2003) and Pankaj *et al.*, (2014). Among the fungal bio-agents, soil application of *Trichoderma viride* @ 2.5 kg/ha (T_2) exhibited 34.2 % and 66.1% reduction in final nematode population in soil and root respectively with yield enhancement of 23.7% followed by the application of *Pochonia chlamydosporia* (T_3) and *Purpureocillium lilacinum* (T_4).

But the highest Incremental Cost Benefit Ratio (ICBR) of 2.96 obtained from T_2 indicated the preference of this treatment over rest two fungal bio-agents as well as Carbofuran treatment besides its eco-friendly self-propagating nature.

The result is in agreement with the earlier findings of Pathak *et al.*, (2005). Huang *et al.*, (2009) has reported 38% reduction of root galling caused by *M. graminicola* by application of *Trichoderma spp*.

Similar observations about the fungal bio-agents have also been reported by Shanmuga Priya (2015).

Thus, the application of Carbofuran @ 0.3 g a.i/m^2in the nursery bed and field application of fungal bio-agent *Trichoderma viride* @2.5 kg /ha at 45 days after transplanting could be an alternative recommendation for economic management of root knot nematode *M. graminicola* in transplanted rice.

Table.1 Efficacy of fungal bio-agents for the management of *Meloidogyne graminicola* in paddy

Treatments		Galls/20 seedlings (Number)	% Decrease	Final Nematode population				Yield		ICBR
				200cc Soil (Number)	% Decrease	5g Root (Number)	% Decrease	Q/ha	% Increase	
T_1	Untreated	153.00 (12.37)*	-	271.50 (2.43)**	-	77.50 (8.80)*		37.05	-	
T_2	Carbofuran (N) + *T. viride* (M)	46.75 (6.83)	69.44	120.00 (2.08)	34.2	26.25 (5.12)	66.12	45.83	23.70	1:2.96
T_3	Carbofuran (N) + *P. chlamydosporia* (M)	52.25 (7.22)	65.84	142.25 (2.15)	27.7	37.75 (6.14)	51.29	44.79	20.89	1:2.51
T_4	Carbofuran (N) + *P. lilacinum* (M)	68.00 (8.24)	55.55	168.75 (2.22)	11.1	42.75 (6.53)	44.83	41.07	10.85	1:2.24
T_5	Carbofuran (N + M)	39.25 (6.26)	74.34	94.25 (1.99)	47.5	20.00 (4.47)	74.19	47.02	26.91	1:2.78
SEM (0.05) CD (0.05)		(0.22) (0.47)	-	(0.04) (0.08)	-	(0.30) (0.65)	-	1.62 3.52	-	

N. B
N- Nursery, M- Main field, *- Squreroot transformed value, **- Log transformed value
T. viride / P. chlamydosporia / P. lilacinum = Soil application @ 2.5 kg/ha 45 DAT in the main field
Carbofuran (N + M) = Soil application @ 0.3g a.i/ m^2 at nursery and @ 1 kg a.i/ha in the main field

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